

THE INCIDENCE OF TUBERCULOSIS
AMONG BLIND SCHOOL CHILDREN.

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CAMILLE KERESZTURI

During the school year 1936-1937 the New York Institute for the Education of the Blind undertook an extensive health program, part of which consisted of the examination of the pupils for tuberculosis.² When this part of the study was finished, we wished to compare the incidence of tuberculosis among our blind children with the incidence of the disease in other institutions of similar nature. We were unable to find any article in the available medical literature concerning tuberculosis among the blind. It seems worth while to us, therefore, to report the findings of our study.

There is, of course, an abundant literature concerning the incidence of tuberculosis among normal school children at various age levels in many localities. When one wishes to compare one's findings with the results of others, it is important to keep in mind the following facts:

1. The incidence of tuberculous infection increases as children get older.
2. It seems to be higher if tests with larger doses of tuberculin are used.
3. It varies from one community to another and is lower among rural children.
4. It varies among different races.
5. It is lower among children of well-to-do families who do not live in congested tenements.
6. It is higher among children with tuberculosis in their families.
7. The incidence of tuberculous infection among the general population is on the decline.

Considering all these factors which influence the apparent incidence of tuberculous infection, it is obvious that it is hard to compare our findings with the results of other investigators, who have studied the same problem among normal school children. One should choose a

¹ From the Department of Diseases of Children, Columbia University, New York City.

² This study was made possible through the interested coöperation of Dr. William Barclay Parsons, one of the trustees of the New York Institute for the Education of the Blind; of Dr. Merle E. Frampton, the Principal; and of Mrs. K. D. Longsdorf, R.N., the nurse of the school.

report dealing with children of the same age, of the same racial composition, in the same economic status, with the same exposure to tuberculosis, in the same city about the same time. Since no such study is available, our data cannot be accurately matched with other studies, and the comparisons offered hereafter should be considered to be only approximately correct.

The Institute for the Education of the Blind is a State school with private endowment for the education of partially and completely blind children from the age of 5 to about 22 years. It is a combination of day school and boarding school, but this year only 6 of the 200 pupils went home every night. The rest left the Institute only on weekends. Seventy-five per cent of the pupils are residents of New York City. The school is not in session for two months in the summer. The pupils pay no tuition. Most of the families from which they come are in the class of the parents whose children go to public schools; a few, however, could afford private schooling for their children. As a whole, the school population closely resembles that of a public school in a fairly good neighborhood in New York City. At the time of the present survey 200 pupils were registered in the school. Two of the children were absent during the period of investigation and were not included in this report.

The ages of the pupils ranged from $5\frac{1}{2}$ to 22 years. The mean age was 13.9 years, with a standard deviation of 4.1. This means that about 68 per cent of the children fell between the age limits of 9.8 and 18 years.

The procedure chosen for our study was the following: All the children were tuberculin-tested intracutaneously by the Mantoux method with 0.01 mgm. Old Tuberculin. If the reaction was not unquestionably positive, a second tuberculin test with 1.0 mgm. OT was done. All the positive reactors were examined clinically and roentgenograms of their chests were made, their sputum was examined for tubercle bacilli by smear and by culture, and their erythrocyte sedimentation rates and their diurnal temperatures at four-hour intervals were determined.

TUBERCULIN TESTS

As may be seen from table 1, 198 children received an intracutaneous tuberculin test with 0.01 mgm. OT. Only 22, or 11 per cent, of them gave an unquestionably positive reaction. Of the remaining 176, 134 reacted entirely negatively to this smaller dose; but 14, or 10 per cent, of these gave a definitely positive reaction to the one hundred times stronger

dose of 1.0 mgm. Forty-two of the original 198 subjects gave a suspicious reaction to 0.01 mgm. OT, but 31 of these, or 74 per cent, became definitely positive when 1.0 mgm. OT was used. In other words, of the 198 children tested either with 0.01 mgm. or with this dose and afterward with 1.0 mgm. OT, 67, or 34 per cent, reacted positively. Throughout this study, the standards of Aronson (1) were used for the definition of positive and negative tuberculin reactions.

Among the 198 children originally tested with 0.01 mgm. OT, none showed constitutional reactions, and only one showed local reaction with formation of a vesicle. Of the 134 entirely negative reactors to 0.01 mgm. OT, 14, or 10 per cent, reacted positively forty-eight hours later when tested with 1.0 mgm. Of the 42 children who reacted doubtfully to the smaller dose of OT, however, 31, or 74 per cent, became unques-

TABLE 1
Tuberculin tests among blind children

DESCRIPTION OF TESTS	TOTAL NUMBER OF TESTS	NEGATIVE OR DOUBTFUL	POSITIVE	PER CENT POSITIVE
Initial intracutaneous with 0.01 mgm. OT.....	198	176	22	11
Retest with 1.0 mgm. OT after negative result with 0.01 mgm.....	134	120	14	10
Retest with 1.0 mgm. OT after doubtful result with 0.01 mgm.....	42	11	31	74
0.01 mgm. OT and if negative or doubtful 1.0 mgm. OT.....	198		67	34

tionably positive when tested with the larger dose. Only one of the 176 children tested with 1.0 mgm. OT showed severe local reaction with vesiculation, and 12, or less than 7 per cent, showed constitutional reactions. All of these twelve, except one, had also shown questionably positive local reactions to the original test; they were among the 42 doubtful reactors to the 0.01 mgm. OT dose. The constitutional reactions were very mild, consisting of headaches, malaise, slight fever, and regional lymphadenitis for one to two days.

Judging from the outcome of our tests, we feel that 0.01 mgm. OT is a suitable initial dose. On questionably positive subjects the second test had better be made with 0.1 mgm. OT rather than with 1.0 mgm., in order to avoid unpleasant and unnecessary constitutional reactions, amounting in our series to 7 per cent.

Not all investigators have found entirely consistent results in tests of

this type. Hart (2), for example, states that upon increasing the tuberculin test dose from 0.01 mgm. to 10.0 mgm., 4 per cent additional positive reactors are found; but Barnard, Amberson and Loew (3) found 15 per cent more positive reactors when they used 1.0 mgm. OT than when they used 0.1 mgm. for the Mantoux tests. Our experience was that increasing the test dose from 0.01 mgm. OT to 1.0 mgm. on definitely negative reactors disclosed 10 per cent more positive cases. But when questionably positive reactors to 0.01 mgm. OT were retested with 1.0 mgm., 74 per cent of them became definitely positive. If one wishes to discover all the positive reactors, therefore, it seems worth while to increase the tuberculin test dose to 1.0 mgm.

Our total of 34 per cent positive reactors out of the original 198 tested is considerably lower than the 67 per cent which Barnard, Amberson and Loew (3) found in a group of 1,000 white school children in the Bellevue-Yorkville district of New York City. The age distribution of their group was 12 to 15 years, and the OT dosage 0.1 to 1.0 mgm. On the other hand, no significant difference is apparent between our present findings and those obtained with 7,668 cases at Bellevue by Smith (4), or with 1,605 children tested by us at the former Fifth Avenue Hospital (5), or with the 14,699 children and infants reported by Drolet (6).

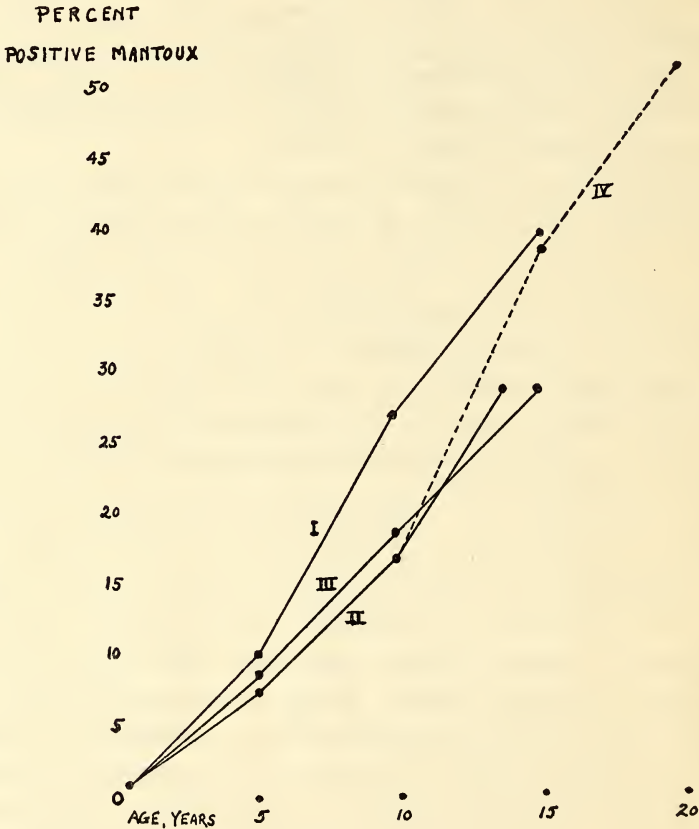
Graph 1 compares four surveys of the incidence of tuberculosis of children in New York City. Although there is a difference of 5 to 16 years between the dates when the different groups were tested, and although the testing dose of Old Tuberculin also varied in the different surveys, the four curves run remarkably nearly parallel. This result was unexpected, because we had anticipated lower figures for blind children than for normal children. It had seemed probable that, since blind children would be prevented by their very blindness from moving freely in public places where the chances of extrafamilial tuberculous infection are great, a lower incidence of tuberculosis would naturally occur. Perhaps the factor of lesser exposure was counterbalanced by closer confinement of the blind in smaller places with one another and with the members of their own families. Whatever the explanation may be, the fact is clear that the incidence of infection with tuberculosis in this group of blind children in New York City is the same as among children with normal vision.

One might object, perhaps, that it is not fair to compare statistics from hospitals and from schools. Drolet (6), however, did not find any significant difference in the incidence of tuberculous infection between

subjects in well-baby clinics and those in hospitals. On the assumption that his findings are accurately representative, it seems fair, then, to compare statistics from schools and from general hospitals.

GRAPH 1

Incidence of tuberculosis infection in various groups of children in New York City



I, Bellevue, 1921-1928, 0.05-2.0 mgm. OT.

II, Fifth Avenue Hospital, 1930-1931, 0.1 mgm. OT.

III, Drolet, 1930-1932, 0.01-1.0 mgm. OT.

IV, Blind Children, 1937, 0.01-1.0 mgm. OT.

Of the 200 pupils at the school, 122 were males and 78 females. Forty per cent of the boys were positive reactors. Of the 76 girls, 22 per cent were positive. Most authors have found no significant difference between the incidence of tuberculous infection in boys and girls.

As may be seen from table 2, Americans (27 per cent) and Italians (18 per cent) predominated in the population of the Institute, and totaled approximately half the group. Negroes made up another 10 per cent,

TABLE 2

Race and nationality distribution of pupils of the New York Institute for the Education of the Blind

	<i>per cent</i>
American.....	27
Italian.....	18
Negro.....	10
Jewish.....	9
Russian.....	5
Irish.....	4
German.....	3
Others.....	10
Mixed nationalities.....	14
	<u>100</u>

TABLE 3

Comparison of different forms of abnormal shadows in the roentgenograms of tuberculin-positive children

NATURE OF SHADOW	BARNARD AND AMBERSON'S SERIES		OUR SERIES	
	Number	Per cent	Number	Per cent
In lung parenchyma.....	26	14	3	20
Enlarged tracheobronchial shadow.....	89	49	8	53
Primary complexes.....	69	37	3	20
Thickened pleura.....	0		1	7
All Mantoux-positive cases with abnormal chest roentgenograms.....	184 out of 670*	29	15 out of 67	22
Clinically significant shadows in tuberculin-positive group.....	15 out of 184	8	3 out of 67	4
Clinically significant shadows in entire group....	15 out of 1000	1.5	3 out of 198	1.5

* 13, or 7 per cent, of these were tuberculin-negative.

and Jews 9 per cent. The figures in this table are based on information about the birthplaces of the parents.

We do not believe that there is enough difference in the incidence of tuberculous infection among different races to justify a comparative

analysis of our small series and other New York groups from the point of view of race and nationality.

Two, or 1.5 per cent, of the 131 tuberculin-negative children were exposed to known tuberculosis in their homes. Five, or 7 per cent, of the tuberculin-positive subjects were similarly exposed. Among the children who showed abnormal roentgenographic shadows suggesting pulmonary or mediastinal involvement, the incidence of known exposure to tuberculosis was 2 out of 15, or 13 per cent. In Barnard, Amberson and Loew's series (3), 9 per cent of the patients with abnormal roentgenograms were known to have been exposed to intrafamilial tuberculosis.

ROENTGENOGRAMS OF THE CHEST³

The thoraces of all the positive reactors to Old Tuberculin were examined roentgenographically in the posteroanterior direction. Fifteen of the 67 cases, or 22 per cent, showed abnormal shadows. Only 3 of the 15, however, or 4 per cent of the 67, had what we interpreted as clinically significant shadows. In other words, 3 patients, or 1.5 per cent of the entire group of 198 children examined, showed clinically significant shadows. This figure is within the limits of expected clinical tuberculosis in the average New York City school population, and is identical with the ratio of manifest tuberculosis found by Barnard, Amberson and Loew (3) in their study of 1,000 unselected school children.

It is noteworthy that 12 of our 15 subjects who showed abnormal roentgenographic shadows in the chest were boys. Of the 3 patients with what we considered clinically significant lesions, 2 were males and 1 female. Barnard, Amberson and Loew (3) also found that more boys than girls showed abnormal roentgenograms. Our roentgenographic results were in all respects closely similar to those of Barnard, Amberson and Loew.

SUBJECTIVE COMPLAINTS AND PHYSICAL EXAMINATION

Three of the 15 roentgenographically positive children showed a stationary weight curve. One child had slight cough, and one showed a temperature up to 100.2°F. None of the children had any expectoration, and only one of them was obviously malnourished. Only one of the patients who showed abnormal roentgen shadows had occasional râles in one of the apices after cough. A roentgenogram of this patient showed

³ Read by Dr. John Coffey of Babies Hospital, New York City.

bilateral apical changes. The other 14 cases were all normal on careful physical examination.

EXAMINATION OF THE SPUTUM

As only one of the children manifested any cough, we attempted to obtain specimens of sputa by training patients to cough forcibly and repeatedly. Twelve of the 15 roentgen-positive patients could produce satisfactory specimens of sputum for study. None of the sputa showed tubercle bacilli, either by smear or by culture. The examination of gastric content of our children could not be carried out in this school survey.

TABLE 4

Erythrocyte sedimentation rates (one hour values) on patients with positive Mantoux tests and pathological roentgenograms

RATE IN 1 HOUR *	NUMBER OF CASES	TYPE OF CASES
Less than 10 mm.	6	4 Tracheobronchial shadows 2 Parenchymal shadows
10-20 mm.	7	3 Tracheobronchial shadows 3 Primary complexes 1 Thickened pleura
20-30 mm.	1	1 Peribronchial lymph node enlargement
30-40 mm.	1	1 Parenchymal shadow

* Modified Westergren technique used; normal values are below 15 mm. per hour.

ERYTHROCYTE SEDIMENTATION RATES

As table 4 indicates, 13 of the ESR values among the 15 children who had a positive tuberculin test and some abnormal shadow in roentgenograms of the chest were within normal limits. One of the children who showed calcified peribronchial shadows had an ESR of 27 mm. in one hour. The highest ESR value, 38 mm. in an hour, occurred in one of the three children who showed clinically significant parenchymal shadows.

CAUSES OF BLINDNESS

Judging by the fact that the incidence of tuberculous infection in our group was not higher than in similar groups of children in New York City having good vision, we can assume that tuberculosis was not often

the cause of blindness among the pupils of the New York Institute for the Education of the Blind.

Table 5, prepared by the Committee on Statistics of the Blind, shows the various known causes of blindness among the pupils of the New York Institute for the Education of the Blind and in 27 other similar institutions. Since tuberculosis as an aetiological factor is not separately listed, it may be assumed that it occupies an insignificant place among the causes of partial or complete loss of sight.

TABLE 5*

Summary of statistics on causes of blindness

New York Institute for the Education of the Blind and 27 other schools and classes for blind

ALL CAUSES—ETIOLOGICAL	NEW YORK IN- STITUTE FOR THE EDUCATION OF THE BLIND	27 OTHER SCHOOLS AND CLASSES FOR THE BLIND
	<i>percentage</i>	<i>percentage</i>
1. Infectious diseases:		
a. Measles.....	1.2	1.1
b. Meningitis.....	3.1	1.8
c. Ophthalmia neonatorum (gonorrhoeal)	12.0	12.1
d. Syphilis.....	3.1	4.6
e. Others not specified.....	8.0	10.1
Total, infectious diseases.....	28.3	29.7
2. Traumatic and chemical injuries.....	9.8	8.1
3. Toxic poisoning.....	0.0	0.1
4. Noninfectious systemic diseases.....	3.1	1.2
5. Neoplasms.....	2.5	2.1
6. Congenital and hereditary.....	53.2	48.3
7. Aetiology not specified.....	3.1	10.5

* Prepared by the Committee on Statistics among the Blind.

DISPOSITION OF CASES

In our survey in the New York Institute for the Education of the Blind, we found, among the 198 children examined, 52 who showed tuberculous infection without evidence of clinical disease. Twelve children showed arrested pulmonary tuberculosis of childhood type which did not require treatment. Three pupils manifested the adult type of pulmonary tuberculosis with mild clinical significance. It was advised that two of these latter children be observed at home and in school, and that the third be sent to a sanatorium for tuberculosis.

SUMMARY AND CONCLUSIONS

1. A survey was made of the incidence of tuberculosis among 198 completely or partially blind school children ranging in age from 5 to 22 years.

2. The frequency of tuberculous infection as determined by 0.01 to 1.0 mgm. Old Tuberculin intracutaneously was 34 per cent, or about the same as in school children of similar age but with good vision, living in New York City.

3. The incidence of pathological roentgenographic changes in the tuberculin-positive group was 22 per cent, and the incidence of clinically significant shadows in the same group was 4 per cent.

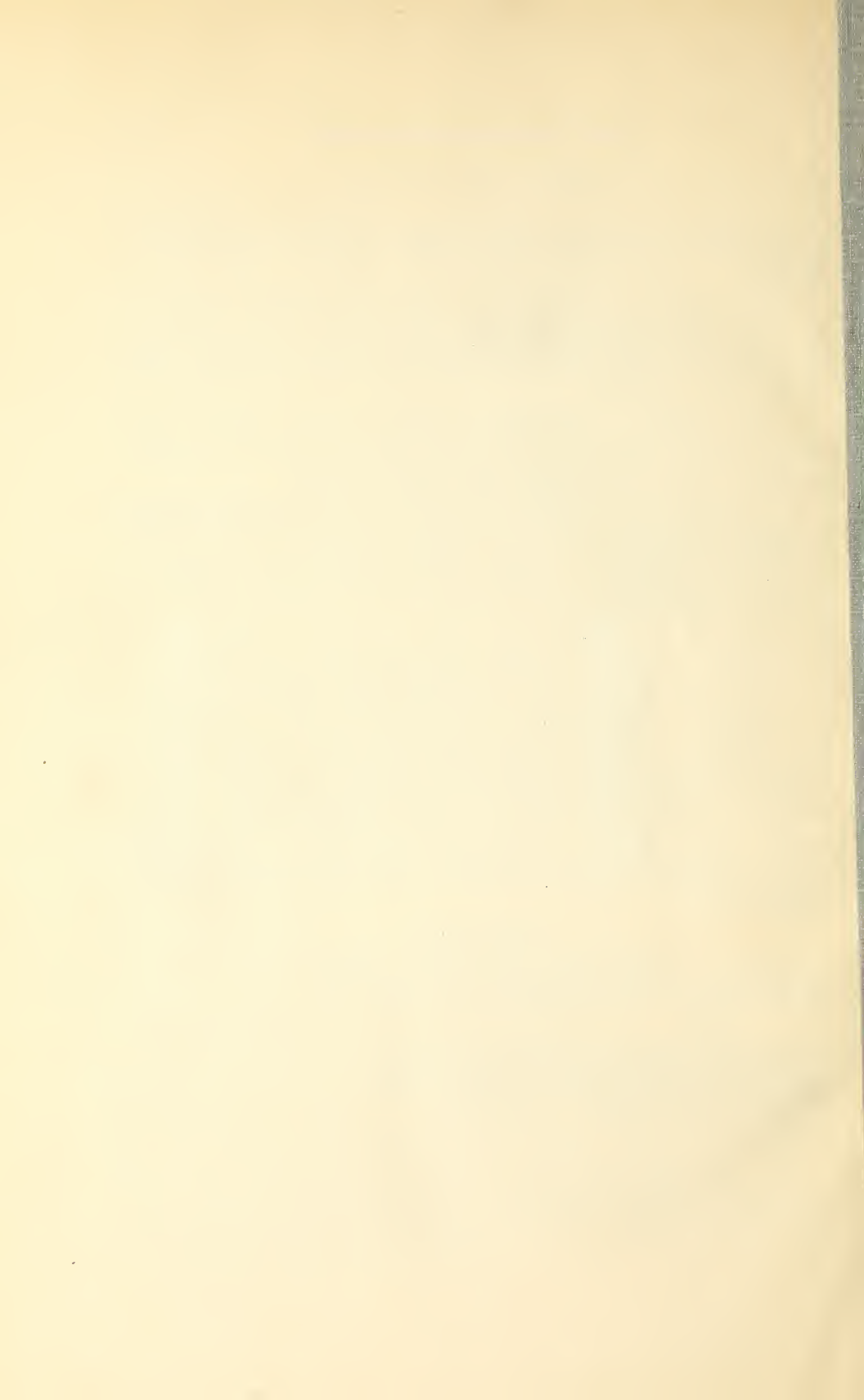
4. If we express the incidence of our positive roentgenological findings in terms of the entire group of 198 children examined, we find 7.5 per cent of the total number showing abnormal shadows, and one-fifth of these, or 1.5 per cent of the whole group of 198, showing shadows of apparent clinical significance.

5. None of the children who showed abnormal roentgenological shadows had a positive sputum by either smear or culture.

6. As a result of our survey among 198 blind children at the New York Institute for the Education of the Blind, 67, or 34 per cent, have been diagnosed as being infected with tuberculosis. Of this number, 15 showed roentgenological evidence of the disease in the lungs. Twelve of these 15 showed an apparently arrested childhood type of tuberculosis and 3, probably, an adult type of the disease. Only one child needed sanatorium care, and two others careful observation and periodic examinations.

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